

**Addressing Feeding Disorders in Children on the Autism Spectrum in
School-Based Settings: Physiological and Behavioral Issues**

Jennifer Twachtman-Reilly, Sheryl C. Amaral, and Patrecia P. Zebrowski
Lang Speech Hear Serv Sch 2008;39;261-272
DOI: 10.1044/0161-1461(2008/025)

The references for this article include 11 HighWire-hosted articles which you can
access for free at: <http://lshss.asha.org/cgi/content/full/39/2/261#BIBL>

This article has been cited by 6 HighWire-hosted article(s) which you can access for
free at:

<http://lshss.asha.org/cgi/content/full/39/2/261#otherarticles>

This information is current as of September 24, 2013

This article, along with updated information and services, is
located on the World Wide Web at:

<http://lshss.asha.org/cgi/content/full/39/2/261>



AMERICAN
SPEECH-LANGUAGE-
HEARING
ASSOCIATION

Clinical Forum

Addressing Feeding Disorders in Children on the Autism Spectrum in School-Based Settings: Physiological and Behavioral Issues

Jennifer Twachtman-Reilly

Autism & Developmental Disabilities Consultation Center, LLC, Higganum, CT

Sheryl C. Amaral

Cumberland School Department, Cumberland, RI

Patrecia P. Zebrowski

Sargent Rehabilitation Center, Warwick, RI

Eating difficulties have been observed in children with autism spectrum disorder (ASD) on a widespread basis since the earliest diagnostic descriptions of the disorder (Kanner, 1943/1985). And, although the presence of feeding difficulties is not used to determine if a child fits the diagnostic profile for ASD, problems with eating are typically a part of the repertoire of symptoms for a child with ASD (Ornitz & Ritvo, 1968/1985; Schreck, Williams, & Smith, 2004; Williams, Dalrymple, & Neal, 2000).

Despite the preponderance of feeding difficulties in children with ASD, research regarding their specific nature is in its infancy

(Ahearn, Castine, Nault, & Green, 2001; Field, Garland, & Williams, 2003; Schreck & Williams, 2006; Schreck et al., 2004; Williams, Gibbons, & Schreck, 2005). This research is found mainly in the behavioral, psychological, and nutritional literature. Although speech-language pathologists (SLPs) play a strong and important role in the treatment of swallowing and feeding difficulties across many populations, the speech-language literature has yet to contribute to the growing body of research regarding the specific expression of, and treatment for, feeding difficulties in children with ASD. The complex pattern of strengths, weaknesses, and needs that is characteristic of children with ASD gives rise to a wide variety of additional

ABSTRACT: Purpose: The purposes of this article are to define the nature of feeding difficulties in children with autism spectrum disorder (ASD), identify important components of the assessment and treatment of feeding disorders specific to this population, and delineate specific therapeutic techniques designed to improve assessment and treatment within the school setting.

Method: Literature review and case example are used to define the predominant nature of the feeding difficulties that are experienced by some children on the autism spectrum. Characteristics of this complex disorder that can have an impact on feeding skill and behavior are also identified. These factors are then integrated to

create assessment and intervention techniques that can be used in conjunction with traditional feeding approaches to facilitate improvements in eating in this unique population.

Implications: The complex nature of ASD and its many influences on feeding skills and behavior create the need for modification to both assessment and treatment approaches. Additional research is needed to create therapeutic protocols that can be used by school-based speech-language pathologists to effectively assess and treat feeding difficulties that are commonly encountered in children with ASD.

KEY WORDS: autism, feeding, assessment, intervention

influences on feeding skills and behavior, the bases of which must be understood and applied by SLPs as they design need-based interventions for this population.

The goal of this article is to discuss the specific presentation of feeding difficulties that are typically experienced by children on the autism spectrum, as well as how the complex pattern of strengths and needs that define ASD relates to the source of feeding difficulties, participation in assessment tasks, and provision of effective treatment. Thus, when feeding issues are present, specific additions and modifications to assessment and intervention practices need to take into account the unique characteristics of students with ASD. Finally, it is hoped that this article will lead to research related to feeding issues for the population of students with ASD within the field of speech-language pathology, as this discipline is in a unique position to integrate the social, communicative, linguistic, cognitive, and oral motor aspects of this complex disorder into an effective, holistic treatment package.

THE PREVALENCE AND NATURE OF FEEDING DIFFICULTIES IN CHILDREN WITH ASD

Investigations regarding the prevalence of feeding problems in children with ASD have consisted mainly of surveys sent to the children's parents. Although informative, such data can be prone to bias because families who are experiencing feeding difficulties may be more likely to return surveys. Kerwin, Eicher, and Gelsinger (2005) reported that although more than 60% of parents surveyed indicated that their children with ASD had strong food preferences, only 6.7% of these parents described their children as having feeding problems. Williams et al. (2000) reported a similar rate of 67% of survey respondents describing their children as being picky eaters. Schreck et al. (2004) found that participants on the autism spectrum ate a more restricted range of foods and had higher rates of food refusal than did their neurotypical peers. Participants also had more utensil requirements and stringent mealtime requirements such as specific food presentation. Other investigations of food acceptance and preference patterns have reported the presence of restricted diets in children with ASD (Ahearn et al., 2001; Kuschner, Bennetto, & Silverman, 2005; Schreck & Williams, 2006; Williams et al., 2000), as well as some tendency for cyclical fluctuations in the volume and variety of foods consumed (Kerwin et al., 2005). In addition, the presence of unusual eating behaviors such as food cravings and pica (i.e., eating inedible items; Kerwin et al., 2005; Raiten & Massaro, 1986) was reported.

Field et al. (2003) audited 349 cases of children who had been evaluated by an interdisciplinary feeding team. Of these, 225 were identified as having developmental disabilities, a population that was later divided into three diagnostic categories for which the prevalence of five functionally defined feeding problems was assessed. Children with ASD demonstrated significantly higher instances of food selectivity by type, and lower instances of food refusal and oral motor problems, than did children in the other two groups. Selectivity by type was defined as "eating a narrow range of food that was nutritionally inappropriate...eating only a few different foods and often [refusing] to eat entire food groups" (Field et al., 2003, p. 300). A defining feature of this category was the consistency with which the child ate a restricted range of foods.

In conclusion, there is general agreement within the research literature that the predominant nature of feeding disorders in children with ASD is that of food selectivity. More severe dysphagia involving aspiration has not been reported in the autism literature, suggesting that it is only seen in those children with ASD who also experience additional medical issues (e.g., seizure disorder, chromosomal syndrome, or other neurological impairment). Field et al.'s (2003) case audit suggests that this may also be true regarding oral motor difficulties that impact feeding. When the study population includes children with ASD and more complex needs, the incidence of oral motor difficulties, as assessed by both imitation and automatic production of tongue and lip movements, rises dramatically (Page & Boucher, 1998). Page and Boucher also assessed chewing and drooling, finding that difficulties in these areas were less prevalent than the production of lip and tongue movements. Given this, the scope of the foregoing discussion will be limited to issues related to the physiological and behavioral bases of food selectivity in children with ASD.

FACTORS THAT INFLUENCE FEEDING DIFFICULTY IN CHILDREN WITH ASD

Causes of swallowing and feeding disorders are usually multifactorial. Burklow, Phelps, Schultz, McConnell, and Rudolph (1998) found that the majority of children with a broad range of medical and developmental etiologies demonstrated both physiological and behavioral factors in their feeding problems. Separation of physiological aspects of feeding difficulty from behavioral aspects is especially difficult in ASD because physiologically based difficulties in this population are often subtle and difficult to pinpoint, and "behavioral" difficulties are not always behavioral (i.e., willful or volitional acts of noncompliance), but rather a reflection of the characteristics and symptoms of this multifaceted disorder.

Research is beginning to define the complex pattern of neurobiological differences that characterize ASD as well as its influence on behavior (Just, Cherkassky, Keller, & Minshew, 2004; Minshew, Sweeney, & Luna, 2002). At a basic level, this research has confirmed that the atypical behavior that is exhibited by people with ASD is a direct result of neurobiological differences. According to Minshew (as cited in Twachtman-Cullen, 2004, p. 39), "the inability of individuals with autism to think differently and behave differently in certain circumstances is not willful but rather the consequence of real differences in their brains." In the sections that follow, components of ASD symptomatology that can influence eating behavior, and how they are manifested, will be defined.

Physiological Issues

For the typical "picky eater" on the autism spectrum, a physiological basis for the feeding problem is not always readily apparent. This can lead to an overemphasis on the behavioral components of the feeding difficulties. Although behavioral issues clearly play an important role in the eating habits of children on the autism spectrum, they are not the only source of feeding difficulty. This section will address two types of physiological issues that can directly or indirectly impact feeding skills and/or behavior: sensory processing issues and gastrointestinal (GI) issues.

Sensory processing issues. Sensory modulation allows an individual to appropriately filter the multitude of sensory information that constantly bombards the nervous system. It does this by inhibiting irrelevant input and alerting the individual to relevant stimuli so that he or she is able to respond to incoming information based on the task at hand and the environmental demands. Dysfunction in one's ability to modulate sensory input can be exhibited as hyperresponsivity, hyporesponsivity, and/or fluctuating responsivity (Lane, Miller, & Hanft, 2000), resulting in atypical responses such as sensory seeking or sensory avoidance behaviors. Such sensory processing difficulties have been acknowledged to be part of the diagnostic picture of ASD for several decades (e.g., Iarocci & McDonald, 2006; Ornitz & Ritvo, 1968/1985). Behavioral research using standardized questionnaires such as the Sensory Profile (Dunn, 1999) has identified sensory processing difficulties that both directly and indirectly impact eating processes (e.g., abnormal responses to taste and smell; heightened sensitivity to tactile input; and auditory filtering problems) (Rogers, Hepburn, & Wehner, 2003). Tomchek and Dunn (2007) found that items that were directly related to feeding (e.g., will only eat certain tastes; picky eater, especially regarding food textures) were significantly elevated in children with ASD in comparison to those of typically developing age-matched peers. Recent research measuring the physiological reactions of children with ASD revealed not only a range in intensity of sensory responses, but also the variability of sensory processing difficulties in this population (Miller, Schoen, Brett-Green, Reale, & Coll, 2005).

Kuschner et al. (2005) directly examined the relationship between taste processing and food preferences in children with ASD. These researchers found that the participants with ASD demonstrated more restrictive food preferences than did controls, with their preferences being based on both the texture and flavor of the food. Interestingly, Kuschner et al. found that participants with ASD were less accurate than controls at identifying general tastes, and there was a significant positive correlation between taste accuracy and greater acceptance of textures and flavors.

Given these distortions in sensory processing, and depending on the number and type of sensory stressors in the environment, the impact on feeding can be pervasive. For example, within a cafeteria setting, a multitude of sensory experiences occur that would not be noticed by the typical student: the smell of food cooking in the kitchen, the visual flickering from fluorescent lights, the constant movement of students within the lunchroom, and the rising noise of conversations reverberating from the cafeteria walls. However, the student with ASD may have difficulty filtering out all of this input, experiencing it as a sensory onslaught to his or her nervous system. Behavioral responses to this experience may be that of *fight* (e.g., screaming or becoming aggressive), *flight* (e.g., fleeing the environment), or *fright* (e.g., shutting down and not being able to eat or socialize with peers). To complicate matters, children with ASD may exhibit variable responses to sensory input, resulting in vacillating behavioral outcomes that may be difficult to predict and can be easily misconstrued as being under the volitional control of the individual. Those working with children with ASD must be vigilant observers to effectively interpret and/or predict behaviors that may be a result of abnormal sensory processing. Some of the possible behavioral responses for each sensory system, and the impact that they may have on eating, are characterized in Table 1.

GI issues. GI disorders encompass a constellation of problems, including gastroesophageal reflux disease (GERD) and constipation, diarrhea, or other symptoms resulting from food allergies (Volkmar & Wiesner, 2004). There is widespread speculation regarding the prevalence of GI issues in children with ASD. A whole population study by Black, Kaye, and Jick (2002) found that children with ASD were no more likely than neurotypical controls to present with a history of GI disorders before receiving the diagnosis of ASD. Although Horvath, Papadimitriou, Rabsztyrn, Drachenberg, and Tildon (1999) reported a much higher incidence of GI issues in children with ASD, participants in that study were chosen based on the prevalence of one or more GI symptoms.

Table 1. Possible effects of sensory modulation difficulties on mealtime behavior.

Type of system	Hyperresponsive	Hyporesponsive
Auditory	Overly sensitive to sound in the mealtime environment <i>Possible symptoms:</i> Cover ears, anxious, aggression, cry, yell, withdrawn, distracted	Unaware of sounds in the mealtime environment <i>Possible symptoms:</i> Daydreaming, "spacey," lengthy meal times
Visual	Overly sensitive to light and movement in the environment <i>Possible symptoms:</i> Shield eyes, squint, avert gaze, withdrawn, anxious, distracted resulting in a reduction in food intake	Unaware of relevant or changing visual input in the environment. <i>Possible symptoms:</i> Overfocused on irrelevant visual features of the food or plate, inattentive to complete meal
Gustatory	Overly sensitive to a variety of tastes <i>Possible symptoms:</i> Picky eater, prefer bland flavors, food refusals, gagging	Poor taste discrimination. <i>Possible symptoms:</i> Crave strong flavors (sour, spicy, etc.), lick or taste inedible objects
Olfactory	Overly sensitive to smells that others do not notice <i>Possible symptoms:</i> Picky eater, distressed, anxious, withdrawn	Unaware of even strong environmental odors <i>Possible symptoms:</i> Disinterested in eating without the enhancement of smell
Tactile	Overly sensitive to tactile input to the skin and/or oral areas <i>Possible symptoms:</i> Dislike messiness around mouth, prefer neutral temperatures, food refusals	Unaware of touch and differences in food textures <i>Possible symptoms:</i> Unaware of messiness around mouth, over-stuffing or pocketing food, mouthing inedibles.
Vestibular	Overly sensitive to movement or change in head position <i>Possible symptoms:</i> Poor coordination for utensil use, fearful in unsupported seating	Seeks high levels of movement input <i>Possible symptoms:</i> Poor posture, high activity level, fidgety
Proprioceptive	Poor body awareness and grading force <i>Possible symptoms:</i> Messiness, poor gradation of jaw and hand to mouth movements	Poor body awareness and grading force <i>Possible symptoms:</i> Messiness, poor gradation of jaw and hand to mouth movements

Field et al. (2003), in their sample of children with ASD who were evaluated in a feeding clinic, reported that in addition to food selectivity by type and texture, some instances of more complex feeding disorders such as dysphagia and food refusal were also documented. Interestingly, all of the children with ASD in this study who were identified with food refusal also had the medical diagnosis of GER. Furthermore, among all of the subject groups, GER was the most prevalent condition and was the factor that was associated most often with food refusal (Field et al., 2003).

Williams et al.'s (2000) survey revealed that 23% of children with ASD and concomitant GI problems were reported to have a poor appetite as compared to 2% of their counterparts without GI problems. Both of the above studies suggest an association between GERD and feeding difficulties such as food selectivity (Field et al., 2003; Williams et al., 2000).

Concern regarding GI issues has led some families to use specialized diets with their children with ASD. Although it is beyond the scope of this article to speculate regarding the effectiveness of specialized diets, it is important for the school-based SLP to be aware of their existence. A large population study by Witwer and Lecavalier (2005) reported that 15.5% of children with ASD were on what was referred to as a "modified diet," and 17.3% had taken some type of nutritional supplement. More recently, Wong and Smith (2006) found that more than half of their participants reported using some type of complementary and alternative medicine therapy, 70% of which were described to be special diets or supplements. In a school setting, SLPs and other interdisciplinary team members may be asked to use only snacks or food with children with ASD, in therapy or at mealtime, that are strictly within the confines of the specific diet that the child is following. This may impact the use of motivating foods as well as create general resistance to the presentation of new foods associated with the diet.

Children with ASD that present with any type of GI issue often have difficulty expressing their discomfort and/or correctly identifying its source. This affects the children's ability to obtain relief or prevent the discomfort from recurring. In some cases, the children's effort to prevent discomfort may lead to the refusal of larger categories of foods rather than just the particular one causing discomfort. All of these factors—physical discomfort, communication limitations, hunger, and so on—can cause a high level of frustration, which may be manifested as undesirable behavior. Thus, it is important that school-based SLPs use and expand their knowledge of these medical aspects of swallowing and feeding and recommend medical consultation if difficulties are suspected.

Behaviorally Based Issues

Even if the restrictive eating habits of a child with ASD do not adversely affect his or her health, they may nonetheless have a strong negative impact on the feeding experience. This is often misinterpreted as willful noncompliance. Bowers (2002) observed that "no parents [referred to the dietetic service] expressed concern about growth. Parents only expressed concern about the management of the feeding occasion" (p. 142). The negative behaviors frequently observed, however, are an extension of the neurologically based symptoms of ASD. In the following sections, four of these characteristics are described and linked with the research-identified behavioral feeding issues most common to ASD.

Repetitive and ritualistic behavior. The presence of restricted and repetitive interests and behavior is one of the defining characteristics

of ASD (American Psychiatric Association, 2000). Repetitive behaviors (RBs) have been addressed extensively in the research literature, with considerable study focused on factors related to the presence of each of two types of RBs: restricted interests/cognitive inflexibility (higher order) and repetitive motor behavior/stereotypes (lower order), a dichotomy suggested by Turner (1999). Research has suggested that higher order RBs may be more indicative of ASD and less related to the developmental level of the child (Carcani-Rathwell, Rabe-Hasketh, & Santosh, 2006; Szatmari et al., 2005).

The feeding rituals that children with ASD often demand extend to other aspects of mealtime, including insistence on specific methods of preparation, food types, and mealtime rules (Raiten & Massaro, 1986; Schreck & Williams, 2006; Williams et al., 2000). These rituals, as well as the patterns of food selectivity described in the research literature, most frequently exemplify higher order RBs (Ahearn et al., 2001; Raiten & Massaro, 1986; Schreck et al., 2004; Williams et al., 2005; Williams et al., 2000). This indicates that the presence of rituals at mealtime is more likely to be related to autistic symptomatology and its neurological bases than to behavioral noncompliance or purely developmental factors. Many anecdotal reports have documented specific feeding rules, including insistence that all foods on a plate be the same color, eating the same food at each meal, requiring that foods be presented in a particular order, or requiring that foods not touch each other on a plate (e.g., Ernsperger & Stegen-Hanson, 2004; Legge, 2002). Lending credence to this contention is the inclusion by Bodfish, Symons, and Lewis (1999) of an item relating to "eating/mealtime" behaviors in the Repetitive Behavior Scale—Revised (RBS-R; Bodfish et al., 1999). One of six items within the ritualistic behavior subscale, this item lists as examples "strongly prefers/insists on eating/drinking only certain things; eats or drinks items in a set order; insists that meal related items are arranged in a certain way" (p. 3).

Executive function (EF) difficulty. Consideration of EF difficulty in autism has been a subject of research investigations for the past 20 years (Hill, 2004), even though it has received little direct clinical attention. Current research is indicating that only selected components of EF are consistently impaired in children with ASD, with impairments in other components occurring on a case-by-case basis (Lopez, Lincoln, Ozonoff, & Lai, 2005; Ozonoff & Jensen, 1999). Difficulties in two of these areas have particular relevance to the types of feeding difficulties that have been documented in this population (Williams et al., 2005)—planning and mental flexibility (Hill, 2004; Lopez et al., 2005; Ozonoff & Jensen, 1999).

Planning. Planning has been defined as "a complex, dynamic operation in which a sequence of planned actions must be constantly monitored, re-evaluated and updated" (Hill, 2004, p. 26.). The notions of sequencing and self-monitoring have particular relevance for mealtime behaviors. First, complex sequences of behavior are involved in mealtime (e.g., washing hands, obtaining utensils and materials, consuming several foods, coordinating eating and drinking, and cleaning up after the meal). Difficulties with planning and sequencing also reduce the child's ability to predict the outcome of current situations or the occurrence of future events. A lack of predictability can clearly increase anxiety and stress in the person with ASD. Thus, a child who insists on eating the same food prepared the same way at each meal may be attempting to increase the predictability of the mealtime experience.

Difficulty with self-monitoring during the meal may also affect the child's ability to complete the meal because the child may think that he or she is "done" prematurely. This may be manifested as

difficulty with monitoring the amount of food that has been eaten versus that which is needed to maintain health without becoming obese. This would be more likely if the child with ASD does not connect the internal feeling of hunger with the consumption of food (Wing, 1972/1980). Kerwin et al. (2005) reported that 16.9% of the parents they surveyed indicated that their children appeared hungry. Some anecdotal reports have also noted that children with ASD appear to eat based on external stimuli such as the time on a clock or the presence of food rather than on feelings of hunger (Hart, 1989). The child's appetite may also either increase or decrease as a result of taking psychotropic medications (Volkmar & Wiesner, 2004). If a child's appetite regulation is impaired or is unconnected to food consumption, it could force the child to use other methods to monitor food intake (e.g., visual appearance of the amount of food left on the plate; amount of time spent at the table, etc.); this, in turn, could lead not only to difficulty judging when mealtime is finished, but also to over- or undereating.

Mental flexibility. Impairments in mental flexibility have been found to be highly prevalent in persons with ASD (Lopez et al., 2005; Ozonoff & Jensen, 1999). According to Hill (2004), these impairments are indicated by "perseverative, stereotyped behaviour [*sic*] and difficulties in the regulation and modulation of motor acts" (p. 26). Clearly related to the construct of RBs described previously, these impairments are reflected in many of the idiosyncratic eating behaviors and mealtime rituals that have been documented in this population, including insistence on a specific utensil or cup, method of preparation, or type of food, as well as specific rituals surrounding eating (Field et al., 2003; Williams et al., 2005; Williams et al., 2000; Raiten & Massaro, 1986; Schreck et al., 2004).

Fear and anxiety. Fear is a well-known component of pediatric swallowing and feeding difficulty. It can be particularly evident in children who have had to previously endure numerous medical procedures and difficult feedings, even when physical issues have been resolved. This is often manifested as continued resistance to new foods or to oral feeding (Morris & Klein, 1987; Swigert, 1998). Fear, in these instances, is often related to a real, albeit no longer applicable, danger of choking, pain, intrusion, and/or discomfort.

The fear responses of children with ASD can be difficult to decipher because fear may be expressed intensely by the child yet appear to be unrelated to the typical eating dangers of choking or vomiting. This is especially evident in cases where the same children who exhibit food-based fears also engage in eating behavior that puts them at greater risk for choking. Parents can sometimes pinpoint when a fear started, although they may still have difficulty determining its origin. An excellent example is provided by Hart (1989, p. 251):

Suddenly and mysteriously he had developed another phobia. He wouldn't drink water and seemed to believe that thirst could be quenched only by juice, milk or cola.... A new ritual had developed... as soon as he got in the car... he immediately started negotiating beverages for the entire weekend.

Evans, Canavera, Kleinpeter, Maccubbin, and Taga (2005) lend some empirical support to these observations, finding that participants with ASD demonstrated less fear of harm or injury but higher numbers of situation fears (e.g., busy malls, small rooms) and/or medical fears in relation to other comparison groups. Evans et al. also found that "for children with ASD, fears, phobias, and anxieties were [more] closely related to problem behaviors...[than they were] for the other groups of subjects." (p. 3). This finding, in particular,

has important implications for feeding because individuals with ASD who develop a fear of a food or a particular aspect of mealtime may evidence a negative reaction that is stronger than anticipated.

Social and language skills. Mealtime in the public schools typically occurs in a social context. Embedded within the required sequences of behaviors described above are social rules that mediate how these behaviors should be executed. Children with ASD are at a disadvantage here because they are unlikely to understand social rules. This can lead to violations of acceptable social behavior in the form of unsavory and unsightly eating habits (e.g., spitting out or playing with food).

The social demands of the environment may lead to increased stress in the child with ASD, which could lead to reduced appetite and food refusal in this environment. Williams et al. (2000) reported that one third of their survey respondents indicated that their children's eating habits were influenced by changes in "situations and people" (p. 263). Hence, if clinicians and teachers place social demands—for example, engaging in conversation—on the child, this can further complicate and compromise the mealtime experience.

The comprehension issues that are frequently seen in individuals with ASD can also lead to food aversions. Hart (1989) related an example that was shared by a parent whose son refused to eat Thai food because he thought that it was made out of neckties. In this case, the individual's difficulty with understanding multiple meanings of words likely caused him to refuse to eat a particular type of food. As in the previous case, where food selectivity does not appear to be related to a physiological issue, it may be very difficult to determine the source of the feeding difficulty when autistic symptomatology extends to eating behavior.

WORKING SUCCESSFULLY TO ADDRESS FEEDING ISSUES IN CHILDREN WITH ASD

Children with ASD are known to experience difficulty tolerating new situations and those in which expectations are unpredictable or ambiguous. For these children, such situations can precipitate the fight, flight, or fright response described earlier. In addition, firmly entrenched patterns of repetitive behavior and difficulty with mental flexibility can be resistant to therapeutic change. These factors require school-based SLPs to support and/or modify traditional feeding therapy for their clients with ASD. The sections that follow outline specific modifications within the domains of enhancing predictability, defining task expectations, and addressing repetitive behavior patterns.

Enhancing Predictability

Whether a child is being evaluated at a feeding clinic or is receiving therapy at school, preparing the child for what to expect during the process may help to reduce his or her anxiety and increase his or her cooperation. Ideally, preparation should occur in a non-threatening environment before the child enters the therapeutic setting. One preparation technique designed for children with ASD is the use of *social stories* (Gray & Garand, 1993). This methodology uses a specific grammatical format to write a brief, concise story that teaches the student what to expect in a given social situation. The reader is referred to Gray (2000) for more specific information regarding writing procedures. Although their specific utility for

assessment and/or treatment preparation has not been investigated, social stories have shown positive results in the research literature (Kuoeh & Mirenda, 2003; Scattone, Wilczynski, Edwards, & Rabian, 2002). Bledsoe, Myles, and Simpson (2003) have specifically found the social story technique to be an effective method for improving the mealtime behavior of an adolescent with Asperger syndrome. A technique that uses a more script-like format is that of *cognitive picture rehearsal* (Grodén & LeVasseur, 1995). The reader is encouraged to investigate both techniques in order to choose which would be most effective for a particular child.

The amount of preparation needed generally increases as familiarity (of setting, task, etc.) decreases and/or the intrusiveness of procedures increases. For off-site evaluations, we recommend reviewing the story, in conjunction with a demarcation on a calendar, for at least 1 week before the assessment. Taking the child's comprehension skills into account, stories regarding assessment preparation should include information regarding procedures to be completed, behavioral expectations, instruction for obtaining breaks, and the purpose of the assessment. Teachers, parents, paraeducators, and others may also review the story with the child. Preparation regarding the tasks and expectations involved in an initial feeding therapy session should be given on the day of the session, but before it, in a calm environment. Once the child is more familiar with therapy, a visual schedule that depicts the order of therapeutic tasks can be reviewed with the child at the beginning of each session. Predictability can also be established by adapting consistent procedures that define how new foods will be introduced (e.g., touch with hand, touch to lips, smell, taste).

Defining Task Expectations

The therapy schedule defined above provides a broad framework for task expectations when each item is removed from the schedule as it is completed. This will help the child to discern that each task has a clear beginning and ending. Several visually based means may be used, including timers, a visual clock, and/or a number board. In this technique, a series of numbers is written on a piece of paper or on individual cards, with each number representing the number of tasks within each domain on the schedule (e.g., number of bites of food that need to be taken; number of times the child should chew before swallowing). As the student progresses through tasks, each number is crossed out or removed from the board.

Short breaks for the student should be incorporated into the session. Demarcate breaks on the visual schedule in strategic places, or encourage the student to ask for a break when he or she needs one. If the student is expected to ask for his or her own breaks, it is crucial for the clinician to remind the student that breaks can be requested, and to have a visual support (i.e., a "break" card) available for this purpose. Structure all breaks by using a timer or short activity (e.g., simple puzzle) to facilitate the transition back to task. Some students may be given a limited number of "break" cards that they can use at any time during a session.

It may be necessary to frequently modify task expectations and their corresponding visual depictions to facilitate student success and diminish the likelihood of negative reactions. For example, if the clinician typically has a child perform a task five times, but the child shows signs of stress just before he or she is expected to perform the task, the clinician can adjust the number board to allow the child to take fewer turns. The clinician can also offer a break to the student if he or she shows signs of increasing anxiety. In addition,

it may be necessary to modify the presentation of assessment and/or therapy tasks. For example, the child who refuses to eat chicken nuggets at the lunch table may be willing to try them if they are placed in train cars and the child is given a car after each bite.

Addressing Repetitive Behavior Patterns

Children with ASD are natural creators and followers of routines. When these routines involve maladaptive eating practices, the school-based SLP may need to work with teachers and families to create and establish more adaptive mealtime rules and routines. The goal here is not to remove routines, but rather to establish new ones that are more beneficial.

One way to address patterns of food selectivity is to help the child to change the rules for food selection. At the simplest level, give the child strategically selected food choices that meet targeted goals and prevent a unilateral focus on one food or group of foods. It may also be possible to educate some children with ASD regarding nutrition for the purpose of establishing nutrition-based food selection rules. Toomey (2002) recommended that each meal consist of one protein, one starch, and one fruit or vegetable. By giving the child choices for each food category, the clinician can involve the child in creating meals that are more nutritionally balanced. Once the child's diet is sufficiently diverse, the school-based SLP can work with the child's family to establish a general rule that the same food can only be eaten every other day (Toomey, 2002).

Specific routines may also be needed to establish safe eating behaviors. For example, Janzen (2003) recommended the use of eating sequences to prevent problems such as overstuffing food. For example, the sequence, "Take a bite, chew, swallow; take a bite..." (p. 419) may help the child to develop new, safer eating patterns.

ADAPTATIONS TO THE FEEDING ASSESSMENT FOR CHILDREN WITH ASD

The assessment of pediatric swallowing and feeding has been well covered in both the research and clinical literature (Arvedson, 2000; Arvedson & Brodsky, 2002). Rather than reiterating the basic components of the assessment process, this section will highlight those factors that require emphasis or adaptation for children with ASD.

Direct assessment of food selectivity is crucial for children on the autism spectrum. Kuhn and Matson (2004) described several behavior rating scales that they recommend for surveying the eating and mealtime behavior of children with mental retardation. One scale that has been specifically designed for individuals with intellectual disabilities is the Screening Tool of Feeding Problems (STEP; Matson & Kuhn, 2001). This 23-item scale is based on the research-identified feeding difficulties that are common to this population (e.g., food selectivity, food refusal). Of particular utility is that this scale includes items designed to identify behaviors that put the child at risk for aspiration (Matson & Kuhn, 2001). The SLP should also informally note the presence of unsafe eating behaviors (e.g., overstuffing food into the mouth; swallowing food without chewing) that put the child at risk for choking even in the absence of a physiologically based swallowing disorder.

A key factor in the assessment of feeding issues in a child with ASD involves determining patterns of consistency or inconsistency

in performance. This can help the school-based SLP to develop hypotheses regarding the possible factors contributing to the symptoms in evidence—for example, whether each is related to sensory processing issues or to cognitive inflexibility. Inconsistencies in current feeding performance can be persistent across environments, people, and food types. For example, a child may eat a particular food at school but refuse the same food at home, or vice versa. Similarly, a child may eat a cookie if it is whole but refuse to eat pieces of the same cookie.

The assessment of consistency in feeding is best determined through an in-depth interview with the family and multiple mealtime observations. Observations should occur across different meal types (e.g., snack, lunch) and settings (e.g., cafeteria, classroom, therapy room) in order to assess the effects of changes in demand/expectation for eating, food type, and the sensory qualities of the environment. Observation of the student with different staff and/or peer configurations allows the clinician to assess both the generalization of skills and the effect of increased or decreased social demands. It is also important to assess feeding in response to subtle texture and/or flavor changes (e.g., different types of crackers, pudding vs. yogurt) or different mealtime variables (e.g., changes in food preparation, different arrangement on a plate, etc.), as these issues are often associated with feeding difficulty in children with ASD.

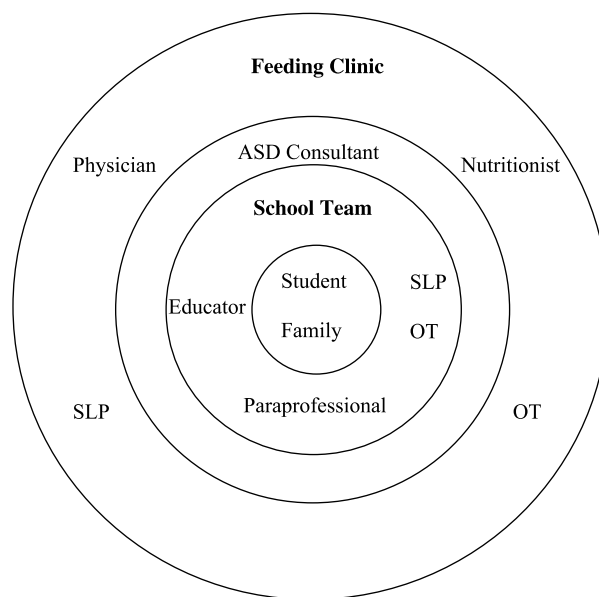
Speech, Language, and Communication Evaluation

Knowledge of the child's receptive and expressive skills is crucial to the design of a feeding program because the child must be able to understand verbal or visual instruction and have at least an elementary understanding of the process of negotiation. EF skills may dictate the complexity of behaviorally based interventions in that if the provision of a reward is too far removed from the target behavior, behavioral change is unlikely. R. L. Gabriels (personal communication, March 10, 2006) further noted that many children with autism have difficulty participating in feeding programs that incorporate pretend play components because this type of play is an acknowledged area of weakness in children with ASD.

Sensory Processing

It is crucial to assess the variable sensory-based factors compiled in Figure 1 because any one of these may influence mealtime and the child's ability to eat successfully, particularly in social settings. A formalized assessment by an occupational therapist specializing in sensory processing disorders is recommended. The Sensory Profile (Dunn, 1999) is one standardized questionnaire that is often used to assess the impact of sensory processing on functional performance. It includes a section for oral sensory processing as well as other domains that would influence eating performance. In addition, it is important to conduct structured clinical observations for sensory factors in the environment that may influence success at mealtime. Miller, Wilbarger, Stackhouse, and Trunnell (2002) developed a format for applying clinical reasoning to observation. The name of the format is derived from the observational categories of sensory, task, environment, predictability, self-monitoring, and interaction (STEP-SI). This observational analysis is used not only to document how the child applies skills to various environments and maintains them, but also to ensure that the clinician is continually aware of the many sensory factors that can influence performance.

Figure 1. Team collaboration for the child with autism spectrum disorder and feeding difficulties.



Note. SLP = speech-language pathologist; OT = occupational therapist.

Boshart (1995/1998) developed a simple assessment tool entitled the Oral Sensory-Motor Analysis. This instrument assesses facial and oral tactile sensitivity as well as oral motor differentiation. Although not specifically designed for feeding, this tool can be used by SLPs to assess tactile hypo- or hyperresponsiveness because either one may impact food acceptance.

In summary, because there are myriad factors that can impact student performance, SLPs need to exercise vigilance so that revisions regarding the child's diagnostic picture may be made as information is gathered and refined. This makes the assessment process a very dynamic one, similar to that which has been described for the evaluation of language (Miller, Gillam, & Peña, 2001). This process encourages the clinician to ascertain the student's level of responsiveness to a given treatment strategy within the assessment (e.g., body positioning, use of picture cues). If the strategy is successful, it is included as part of the child's intervention plan. Intervention, in turn, is viewed as a work in progress where strategies are continually modified as the student's responses to them change.

INTERVENTION PRINCIPLES FOR THE SCHOOL-BASED SLP

To the extent possible, intervention must be designed based on the particular types of feeding difficulty that have been experienced by the child with ASD vis-à-vis the suspected origins of these difficulties. For example, a sensory-based feeding difficulty should be treated via sensory-based interventions. Furthermore, as discussed earlier, behaviorally based feeding difficulties are likely to have their origins in neurologically based autistic symptomatology. Hence, it is imperative that the SLP look beyond the superficial presentation of a given feeding problem to its possible underlying cause(s).

By so doing, the resulting intervention practices are likely to address the child's needs more accurately.

Once intervention targets are identified, the success of their corresponding therapeutic procedures is dependent on *how*, *when*, *where*, and *by whom* they are implemented. In keeping with this orientation, the subsections that follow will first define the importance of both therapeutic balance and team collaboration to the success of feeding intervention for children with ASD in the public schools. Following this, intervention procedures designed to remediate specific feeding issues—both those that are research tested and those found to be successful in clinical practice—will be presented. Finally, ways to promote generalization of skills across meal-times in a variety of settings will be discussed.

Therapeutic Balance

Children with ASD are often comfortable in their routines and rituals, contented when eating familiar foods that are prepared and presented in familiar ways, and unaware of social conventions or safety issues that dictate acceptable eating behavior. The school-based SLP who is attempting to change these patterns may face an uphill battle. Although pragmatically based therapy (e.g., that which focuses on improving requesting and protesting skills) offers intrinsic rewards, feeding therapy alone may not offer a reward that is worthy of the child's effort. This demands the inclusion of two important intervention principles: the utilization of behaviorally based techniques such as reinforcement, to be discussed later, and the need for delicate pacing of feeding therapy so that there is a gradual progression of demands.

An optimal therapeutic pace can make the difference between participation and resistance in the student with ASD. There are several components to appropriate pacing. The first component involves respecting the student's current preferences and allowing him or her some choice and control during feeding therapy. Consider the case of a kindergarten student with ASD who preferred crunchy foods. This student would eat yogurt mixed with granola that was sent in by his mother but would refuse pudding at snack time that was part of a special occasion such as a birthday party. This student was gradually able to join with his peers in this activity when they all were given the option of putting crunchy sprinkles in their respective pudding cups. Social praise and encouragement were also important components of this intervention.

The importance of therapeutic balance cannot be overstated for the child who presents with multiple issues in swallowing and feeding. Hence, treatment areas may need to be prioritized and addressed separately. For example, one child may exhibit food selectivity, insistence on self-feeding within a specific ritual, and high-risk choking behaviors. In this case, the SLP's first goal should be to facilitate safe eating behavior with the foods currently in the child's repertoire that are within the child's self-feeding control. Once this is established, the SLP must decide whether to modify the self-feeding behavior or to expand the child's food repertoire. If both issues are addressed at once, the child is likely to be resistant and therapy will be unsuccessful. This decision should take into account information regarding nutrition and health status, the degree to which the problematic feeding behaviors are disruptive, and/or the priorities of the child's parents.

Therapeutic balance must also be exercised regarding the multiple individualized educational program (IEP) goals and objectives within the speech and language and/or education domains. More and more often, special educators and administrators are supporting the

use of lunch/snack groups to address a variety of swallowing and feeding and language-based social issues simultaneously. Importantly, although therapy that targets multiple areas of need, in context, is appealing for a variety of reasons, the school-based SLP needs to be mindful of the student's ability to tolerate multiple therapeutic demands. For example, if a student has severe food aversions linked to anxiety, it may be necessary to remove the social requirements (another likely cause of anxiety in the child with ASD) until feeding issues are better managed.

Team Collaboration

It is the contention of these authors that the feeding issues of students with ASD can be addressed successfully in the naturalistic environment of the school-based setting with involvement of multiple professionals in remediation efforts. Team collaboration is conceptualized in Figure 1. Within the school team, the degree of involvement by each team member is dependent on both his or her level of specialized training in feeding disorders in general, as well as the extent to which he or she has been trained to implement child-specific therapeutic techniques. At the consultation level, individuals with specific expertise in ASD may be called in to address issues such as disruptive behavior and the need for specific educational supports. These supports may also benefit the child at mealtime. The final circle of collaboration involves professionals outside of the school environment, such as experts from swallowing and feeding clinics.

Specific Treatment Techniques

It is not possible in one article to include all of the possible treatment techniques that may be helpful in addressing feeding disorders in children with ASD. The reader is referred to other sources for a more extensive discussion of pediatric dysphagia remediation techniques (e.g., Arvedson & Brodsky, 2002; Swigert, 1998). Therefore, this article focuses on those techniques that may be of specific utility to the population of students with ASD. As with many clinical approaches, there are varying amounts of direct research regarding intervention strategies. The educational benefit derived from some strategies is well researched, but their application to feeding has not yet been investigated directly. Others have not been the subject of formal research but are generally accepted by most clinicians as being effective. As with all intervention, clinical judgment on a case-by-case basis is an essential part of the decision-making process.

Sensory-based treatment techniques. Sensory-based strategies may be needed to address behavioral responses such as decreasing self-stimulatory behavior, improving attention, and regulating the activity level needed for in-seat behavior that may interfere with the child's ability to engage effectively in mealtime. Case studies are emerging that show the effectiveness of sensory-based strategies designed to facilitate the behavioral readiness skills needed for improved functional performance (Fertel-Daly, Bedell, & Hinojosa, 2001; Field et al., 1997; Schaaf & Nightlinger, 2007; Smith, Press, Koenig, & Kinnealey, 2005). However, generalizations regarding application of these strategies to the particular feeding needs of a child with autism cannot be made and require the clinical judgment of the therapist. The occupational therapist can customize sensory-based activities that may be implemented before mealtime as part of a daily "sensory diet" or as part of intervention during mealtime if

he or she determines that the child is able to derive benefit from these activities. The SLP can assist in judging the child's response to these strategies and consult with the occupational therapist when modifications need to be made.

Although the SLP will take on a greater role in the facilitation of oral desensitization, collaboration is nonetheless important because occupational therapists may bring new strategies to the treatment table that complement those employed by the SLP. These interventions can also occur initially in a play environment that is not associated with mealtime so as to allow for the gradual introduction of oral sensory experiences in a less stressful setting at a level that the child can accept and begin to predict. Specific strategies can include a variety of oral and facial massage techniques as well as oral exploration of different tastes, temperatures, textures, and equipment such as straws and chewy tubes. Once the child has become accustomed to the use of these strategies, it may be helpful to introduce them as oral "warm ups" before mealtime.

When the child is ready to experience new foods, it is important to create a nurturing environment for eating and to proceed gradually. Ernsperger and Stegen-Hanson (2004) described five stages of sensory development for eating: *acceptance, touch, smell, taste, and eating*. These stages are particularly relevant for the population of children with ASD because they provide a logical and gradual progression that acknowledges the difficulty that these children may have with even tolerating the presence of new foods on their plate or table (acceptance stage). Because the child controls the pace of this introduction program, it is easily individualized by clinicians to facilitate the consumption of new foods.

Other recommendations include using "child-friendly" foods; choosing small portions; combining new foods with familiar foods; and selecting new foods that are close in flavor, appearance, and/or texture to preferred foods. The use of peer modeling, as well as the introduction of creative and fun activities at each of the stages, may also aid progress by providing a comfortable and relaxed setting for eating (Ernsperger & Stegen-Hanson, 2004).

During mealtime, it is important to consider a variety of sensory-based environmental factors that may impact eating behaviors. Noises, smells, lighting, activity level, movement within the environment, and the presence (or absence) of predictable routines can influence the child's behavior and his or her ability to engage successfully in eating. Clearly defining the physical space for eating, providing a child-sized chair that allows the child to have his or her feet flat on the floor, as well as matching table height to the height of the chair are essential to creating a supportive and comfortable seating arrangement.

Techniques designed to facilitate oral exploration, and those that normalize sensation, are often the first steps to expanding the range of acceptable foods. Oral sensations can be manipulated along several dimensions, including taste, temperature, and texture, depending on the individual needs of the child. For example, the texture of yogurt can be intensified by mixing it with granola or instructing the child in the use of a Nuk brush to eat it. Likewise, the flavor of yogurt can be toned down by mixing a flavored yogurt with plain yogurt.

Behaviorally based treatment techniques. The majority of research articles depicting specific feeding treatment protocols are single-case studies that are found in the behavioral literature. These describe a variety of approaches that were found to be effective in individual cases. Some of these include various methods of food presentation (e.g. Ahearn, 2003), liquid fading (e.g., Luiselli,

Ricciardi, & Gilligan, 2005), the use of reinforcement procedures (e.g., Buckley, Strunck, & Newchok, 2005), backward chaining (e.g., Hagopian, Farrell, & Amari, 1996), and the use of prompting methods (e.g., Ahearn, 2002), among others.

Several of these methodologies have particular relevance to the school-based SLP. First, as noted previously, the way in which food is presented can have a considerable effect on a child's acceptance of it. For example, Ahearn (2003) reported increases in vegetable consumption when a child with ASD was offered condiments along with target foods. In another study involving 6 children with ASD, Ahearn (2002) found that presenting a target food individually resulted in more rapid food acceptance, whereas presentation of the target food along with two other foods from the same food group increased generalization.

Another important behavioral principle involves the manipulation of consequences that change depending on whether the child is engaging in appropriate or unacceptable eating behaviors. Linscheid (2006) summarized these procedures under the rubric of *contingency management*. As discussed earlier in this section, providing external rewards for appropriate eating may be an important motivator for the child with ASD to participate in feeding therapy. Reinforcement can take several forms, including tangible (e.g., sticker, bite of preferred food), sensory (i.e., pleasurable sensory input, such as deep pressure squeezes), and social praise and attention. The type of reward used should be the smallest one necessary to elicit behavior change. Janzen (2003) also recommends following eating periods with preferred activities.

Generalization of Skills

The transfer of skills to new environments must be a systematic component of any feeding program for a child with ASD. For this population, especially, generalization of skills must not be left to chance. In the home environment, Janzen (2003) encourages generalization from the beginning of feeding intervention by recommending that eating locations for snacks be varied frequently. Situational concerns, such as the need to keep environmental stimuli to a minimum or problems in the level of skill development, may affect both the location of therapy and personnel flexibility in the school setting. SLPs, however, are encouraged to include variations in both eating location and persons assisting the child, to the extent possible, as early as possible in order to facilitate generalization. Indeed, generalization to the least restrictive environment possible for safe and effective feeding should be an important part of the child's therapeutic feeding plan.

DIRECTIONS FOR FUTURE RESEARCH AND CLINICAL APPLICATION

Although current research into the feeding disorders that have been experienced by children with ASD has established general patterns of eating behavior and/or difficulty, there are many questions that have yet to be answered. First, more definitive information is needed regarding the incidence of dysphagia in this population and the relative frequency with which it occurs. The field of speech-language pathology is uniquely suited to investigate this topic. In an important first step, some feeding clinics are beginning to track their pediatric populations, and in so doing have reported an increase

in the number of children with ASD who are being evaluated and treated in specialized clinics. For example, the Pediatric Feeding and Swallowing Center at The Children's Hospital of Philadelphia reports that approximately 50% of current referrals are children with ASD. This clinic is also actively assessing the incidences of GI issues and food allergies in these patients (Sharon Greis, personal communication, March 17, 2006). The increase is possibly the result of the specialized types of assessments that this clinic is providing. Although feeding clinics are well suited to report incidence patterns in their patients, it is important to remember that the individuals with ASD who are attending these clinics represent a small sample of the overall population of children with ASD. Thus, more information is needed regarding the feeding strengths and needs of those children who are not evaluated at such clinics.

The next line of research involves questions regarding the relative contributions of the many influences on feeding that were considered in this article. For instance, the relative contributions of various sensory systems to the presence and type of feeding disorders is worthy of research attention. In addition, the relationship between RBs or anxiety and eating behavior can be investigated. Further research is also needed regarding the effectiveness of structure and the use of various visual support systems with respect to improving eating behavior in children with ASD. Although the utility of these systems is generally established for this population (Bopp, Brown, & Mirenda, 2004), their specific application to feeding remains untested.

Clearly, the issues discussed in this article underscore the need for continuing education for SLPs across several domains of practice, including dysphagia; the application of behavioral principles; and, most importantly, the many areas of strength and need that encompass ASD. Effective intervention for students with ASD is dependent on an understanding that the behavior of these individuals is the result of a constellation of neurobiological impairments rather than willful acts of noncompliance. Direct training in the use of the intervention techniques discussed in this article will also help to facilitate the participation of these students in both the assessment and therapeutic process.

Finally, it is important for SLPs to appreciate the distinct and clinically specialized nature of ASD and reflect this in their assessment and intervention practices. The research regarding feeding disorders in this population, and the vast number of influences on feeding skill and behavior, further sets children with ASD apart from the population of children who are experiencing pediatric dysphagia, both with and without accompanying developmental disabilities. Although heterogeneity within this population can complicate the clinical process, it should serve to prompt the SLP to collaborate with other professionals so that the child with ASD may derive benefit from the synergy that evolves from the collaborative team effort.

ACKNOWLEDGMENTS

The authors would like to acknowledge the research assistance of the librarians at the Charles E. Shain Library at Connecticut College and Sturdy Memorial Hospital. Appreciation is also expressed to those who lent their expertise to us in the form of personal communications and research assistance: Sharon Greis, Emily M. Homer, Michael L. Cuccaro, and Robin L. Gabriels. The authors are also grateful for the editorial assistance and expertise of Diane Twachtman-Cullen and the technical assistance of Rachel Vitello and Meghan Krodell.

REFERENCES

- Ahearn, W. H. (2002). Effect of two methods of introducing foods during feeding treatment on acceptance of previously rejected items. *Behavioral Interventions*, 17, 111–127.
- Ahearn, W. H. (2003). Using simultaneous presentation to increase vegetable consumption in a mildly selective child with autism. *Journal of Applied Behavior Analysis*, 36(3), 361–365.
- Ahearn, W. H., Castine, T., Nault, K., & Green, G. (2001). An assessment of food acceptance in children with autism or pervasive developmental disorder—not otherwise specified. *Journal of Autism and Developmental Disorders*, 31(5), 505–511.
- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders (text revision)*. Washington, DC: Author.
- Arvedson, J. C. (2000). Evaluation of children with feeding and swallowing problems. *Language, Speech, and Hearing Services in Schools*, 31(1), 28–41.
- Arvedson, J. C., & Brodsky, L. (2002). *Pediatric swallowing and feeding assessment and management* (2nd ed.). Albany, NY: Singular.
- Black, C., Kaye, J. A., & Jick, H. (2002). Relation of childhood gastrointestinal disorders to autism: Nested case-control study using data from the UK General Practice Research Database. *British Medical Journal*, 325, 419–421.
- Bledsoe, R., Myles, B. S., & Simpson, R. L. (2003). Use of a social story to improve mealtime skills of an adolescent with Asperger syndrome. *Autism: The International Journal of Research & Practice*, 7(3), 289–295.
- Bodfish, J. W., Symons, F. J., & Lewis, M. H. (1999). *Repetitive Behavior Scale—Revised*. Morganton, NC: Western Carolina Center Research Reports.
- Bopp, K. D., Brown, K. E., & Mirenda, P. (2004). Speech-language pathologists' roles in the delivery of positive behavior support for individuals with developmental disabilities. *American Journal of Speech-Language Pathology*, 13(1), 5–19.
- Boshart, C. A. (1998). *Oral-motor analysis and remediation techniques*. Temecula, CA: Speech Dynamics. (Original work published 1995)
- Bowers, L. (2002). An audit of referrals of children with autistic spectrum disorder to the dietetic service. *Journal of Human Nutrition and Dietetics*, 15, 141–144.
- Buckley, S. D., Strunck, P. G., & Newchok, D. K. (2005). A comparison of two multicomponent procedures to increase food consumption. *Behavioral Interventions*, 20, 139–146.
- Burklow, K. A., Phelps, A. N., Schultz, J. R., McConnell, K., & Rudolph, C. (1998). Classifying complex feeding disorders. *Journal of Pediatric Gastroenterology and Nutrition*, 27, 143–147.
- Carcani-Rathwell, I., Rabe-Hasketh, S., & Santosh, P. J. (2006). Repetitive and stereotyped behaviors in pervasive developmental disorders [Electronic version]. *Journal of Child Psychology and Psychiatry*, 47(6), 573–581.
- Dunn, W. (1999). *The Sensory Profile*. San Antonio, TX: Therapy Skill Builders.
- Ernsperger, L., & Stegen-Hanson, T. (2004). *Just take a bite: Easy, effective answers to food aversions and eating challenges*. Arlington, TX: Future Horizons.
- Evans, D., Canavera, K., Kleinpeter, F., Maccubbin, E., & Taga, K. (2005). The fears, phobias, and anxieties of children with autism spectrum disorders and Down syndrome: Comparisons with developmentally and chronologically age matched children. *Child Psychiatry and Human Development*, 36(1), 3–26.
- Fertel-Daly, D., Bedell, G., & Hinojosa, J. (2001). Effects of a weighted vest on attention to task and self-stimulating behaviors in preschoolers with pervasive developmental disorders. *American Journal of Occupational Therapy*, 55(6), 629–640.

- Field, D., Garland, M., & Williams, K. (2003). Correlates of specific childhood feeding problems. *Journal of Paediatric Child Health*, 39, 299–304.
- Field, T., Lasko, D., Mundy, P., Henteleff, T., Kabat, S., Talpins, S., & Dowling, M. (1997). Brief report: Autistic children's attentiveness and responsivity improve after touch therapy. *Journal of Autism and Developmental Disorders*, 27(3), 333–338.
- Gray, C. (2000). *Writing social stories with Carol Gray: Accompanying workbook to video*. Arlington, TX: Future Horizons.
- Gray, C. A., & Garand, J. D. (1993). Social stories: Improving responses of students with autism with accurate social information. *Focus on Autistic Behavior*, 8(1), 1–10.
- Groden, J., & LeVasseur, P. (1995). Cognitive picture rehearsal: A system to teach self-control. In K. A. Quill (Ed.), *Teaching children with autism: Strategies to enhance communication and socialization* (pp. 287–306). New York: Delmar.
- Hagopian, L. P., Farrell, D. A., & Amari, A. (1996). Treating total liquid refusal with backward chaining and fading. *Journal of Applied Behavior Analysis*, 29, 573–575.
- Hart, C. (1989). *Without reason: A family copes with two generations of autism*. New York: Harper & Row.
- Hill, E. (2004). Executive dysfunction in autism. *TRENDS in Cognitive Sciences*, 8(1), 26–32.
- Horvath, K., Papadimitriou, J. C., Rabszty, A., Drachenberg, C., & Tildon, J. T. (1999). Gastrointestinal abnormalities in children with autistic disorder. *Journal of Pediatrics*, 135, 559–563.
- Iarocci, G., & McDonald, J. (2006). Sensory integration and the perceptual experience of persons with autism [Electronic version]. *Journal of Autism and Developmental Disorders*, 36(1), 77–90.
- Janzen, J. (2003). *Understanding the nature of autism* (2nd ed.). San Antonio, TX: Therapy Skill Builders.
- Just, M. A., Cherkassky, V. L., Keller, T. A., & Minshew, N. J. (2004). Cortical activation and synchronization during sentence comprehension in high-functioning autism: Evidence of underconnectivity. *Brain*, 127(8), 1811–1821.
- Kanner, L. (1985). Autistic disturbances of affective contact. In A. M. Donnellan (Ed.), *Classic readings in autism* (pp. 11–50). New York: Teachers College Press. (Reprinted from *Childhood psychosis: Initial studies and new insights*, pp. 1–43, by L. Kanner, Ed., 1973, Washington DC: V.H. Winston) (Original work published in *Nervous Child*, 2 (1943), pp. 217–250.).
- Kerwin, M. E., Eicher, P. S., & Gelsinger, J. (2005). Parental report of eating problems and gastrointestinal symptoms in children with pervasive developmental disorders. *Children's Health Care*, 34(3), 217–234.
- Kuhn, D. E., & Matson, J. L. (2004). Assessment of feeding and mealtime behavior problems in persons with mental retardation. *Behavior Modification*, 28(5), 638–648.
- Kuoch, H., & Mirenda, P. (2003). Social story interventions for young children with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities*, 18(4), 219–227.
- Kuschner, E., Bennetto, L., & Silverman, L. (2005). Gustatory function and food preferences in high-functioning autism [Abstract]. *International Meeting for Autism Research*. (Abstract No. P3A.1.13) 118–119.
- Lane, S. J., Miller, L. J., & Hanft, B. E. (2000). Toward a consensus in terminology in sensory integration theory and practice: Part 2: Sensory integration patterns of function and dysfunction. *Sensory Integration Special Interest Section*, 23(2), 1–3.
- Legge, B. (2002). *Can't eat, won't eat dietary difficulties and autistic spectrum disorders*. London: Jessica Kingsley.
- Linscheid, T. R. (2006). Behavioral treatments for pediatric feeding disorders. *Behavior Modification*, 30(1), 6–23.
- Lopez, B. R., Lincoln, A. J., Ozonoff, S., & Lai, Z. (2005). Examining the relationship between executive functions and restricted, repetitive symptoms of autistic disorder. *Journal of Autism and Developmental Disorders*, 35(4), 445–460.
- Luiselli, J. K., Ricciardi, J. N., & Gilligan, K. (2005). Liquid fading to establish milk consumption by a child with autism. *Behavioral Interventions*, 20, 155–163.
- Matson, J. L., & Kuhn, D. E. (2001). Identifying feeding problems in mentally retarded persons: Development and reliability of the screening tool of feeding problems (STEP). *Research in Developmental Disabilities*, 21, 165–172.
- Miller, L., Gillam, R. B., & Peña, E. D. (2001). *Dynamic assessment and intervention: Improving children's narrative abilities*. Austin, TX: Pro-Ed.
- Miller, L. J., Schoen, S. A., Brett-Green, B., Reale, M., & Coll, J. (2005). *Quantitative psychophysiological evaluation of sensory processing in children with autism spectrum disorders. A final report for cure autism now*. Manuscript in preparation.
- Miller, L. J., Wilbarger, J. L., Stackhouse, T. M., & Trunnell, S. L. (2002). Use of clinical reasoning in occupational therapy: The STEP-SI model of sensory modulation dysfunction. In A. C. Bundy, S. J. Lane, & E. A. Murphy (Eds.), *Sensory integration: Theory and practice* (2nd ed., pp. 435–451). Philadelphia, PA: F. A. Davis Company.
- Minshew, N. J., Sweeney, J., & Luna, B. (2002). Autism as a disorder of complex information processing and underdevelopment of neocortical systems. *Molecular Psychiatry*, 7, S14–S15.
- Morris, S. E., & Klein, M. D. (1987). *Pre-feeding skills: A comprehensive resource for feeding development*. Tucson, AZ: Therapy Skill Builders.
- Ornitz, E. M., & Ritvo, E. R. (1985). Perceptual inconstancy in early infantile autism. In A. M. Donnellan (Ed.), *Classic readings in autism* (pp. 142–177). New York: Teachers College Press. (Reprinted from *Archives of General Psychology*, 18 (January, 1968), pp. 76–98.
- Ozonoff, S., & Jensen, J. (1999). Brief report: Specific executive function profiles in three neurodevelopmental disorders. *Journal of Autism and Developmental Disorders*, 29(2), 171–177.
- Page, J., & Boucher, J. (1998). Motor impairments in children with autistic disorder. *Child Language Teaching and Therapy*, 14(3), 233–259.
- Raiten, D. J., & Massaro, T. (1986). Perspectives on the nutritional ecology of autistic children. *Journal of Autism and Developmental Disabilities*, 16(2), 133–143.
- Rogers, S., Hepburn, S., & Wehner, E. (2003). Parent reports of sensory symptoms in toddlers with autism and those with other developmental disorders. *Journal of Autism and Developmental Disabilities*, 33(6), 631–642.
- Scattone, D., Wilczynski, S. M., Edwards, R. P., & Rabian, B. (2002). Decreasing disruptive behaviors of children with autism using social stories. *Journal of Autism and Developmental Disorders*, 32(6), 535–543.
- Schaaf, R. C., & Nightlinger, K. M. (2007). Occupational therapy using a sensory integrative approach: A case study of effectiveness. *American Journal of Occupational Therapy*, 61(2), 239–246.
- Schreck, K. A., & Williams, K. (2006). Food preferences and factors influencing food selectivity for children with autism spectrum disorders [Electronic version]. *Research in Developmental Disabilities*, 27(4), 353–363.
- Schreck, K. A., Williams, K., & Smith, A. F. (2004). A comparison of eating behaviors between children with and without autism. *Journal of Autism and Developmental Disorders*, 34(4), 433–438.
- Smith, S. A., Press, B., Koenig, K. P., & Kinnealey, M. (2007). Effects of sensory integration intervention on self-stimulating and self-injurious behaviors. *American Journal of Occupational Therapy*, 59(4), 418–425.

- Swigert, N. B.** (1998). *The source for pediatric dysphagia*. East Moline, IL: LinguiSystems.
- Szatmari, P., Georgiades, S., Bryson, S., Zwaigenbaum, L., Roberts, W., Mahoney, W., et al.** (2005). Investigating the structure of the restricted, repetitive behaviors and interests domain in autism [Electronic version]. *Journal of Child Psychology and Psychiatry*, 47(6), 582–590.
- Tomchek, S. D., & Dunn, W.** (2007). Sensory processing in children with and without autism: A comparative study using the Short Sensory Profile. *American Journal of Occupational Therapy*, 61, 190–200.
- Toomey, K. A.** (2002). *When children won't eat: The SOS approach to feeding*. Denver, CO: Toomey & Associates.
- Turner, M.** (1999). Annotation: Repetitive behavior in autism: A review of psychological research. *Journal of Child Psychology & Psychiatry*, 40(6), 839–849.
- Twachtman-Cullen, D.** (2004, Summer). From the decade of the brain to the 21st century [The cutting edge: From research to practice]. *Autism Spectrum Quarterly*, 38–41.
- Volkmar, F. R., & Wiesner, L. A.** (2004). *Topics in autism: Healthcare for children on the autism spectrum: A guide to medical, nutritional, and behavioral issues*. Bethesda, MD: Woodbine House.
- Williams, K., Gibbons, B., & Schreck, K.** (2005). Comparing selective eaters with and without developmental disabilities. *Journal of Developmental and Physical Disabilities*, 17(3), 299–309.
- Williams, P. G., Dalrymple, N., & Neal, J.** (2000). Eating habits of children with autism. *Pediatric Nursing*, 26(3), 259–264.
- Wing, L.** (1980). *Autistic children: A guide for parents and professionals*. Secaucus, NJ: The Citadel Press. (Original work published 1972)
- Witwer, A., & Lecavalier, L.** (2005). Treatment incidence and patterns in children and adolescents with autism spectrum disorders. *Journal of Child and Adolescent Psychopharmacology*, 15(4), 671–681.
- Wong, H. H., & Smith, R. G.** (2006). Patterns of complementary and alternative medical therapy use in children diagnosed with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 36(7), 901–909.

Received April 4, 2006

Revision received January 2, 2007

Accepted June 18, 2007

DOI: 10.1044/0161-1461(2008/025)

Contact author: Jennifer Twachtman-Reilly, Autism and Developmental Disabilities Consultation Center, LLC, P. O. Box 709, Higganum, CT 06441-0709. E-mail: jtreillyslp@sbcglobal.net.